2021

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Kean University

Kean University

School of Environmental and Sustainability Sciences
Program Review Executive Summary

B.S. Earth Sciences (all options)
B.S. Biology (Environmental Option)
B.S. Sustainability Sciences
B.A. Earth Sciences

The School of Environmental and Sustainability Sciences (SESS) provides B.S. degree programs in Earth Science (currently two options for Environmental Science and GeoScience), Environmental Biology, and Sustainability as well as the B.A. degree in Earth Science. This program review provides an overview of accomplishments, success, and progress of these degree programs over the past five years. The mission of the faculty in the SESS at Kean University is to offer nationally and internationally recognized programs that prepare students for a professional and academic career in Environmental and Sustainability Sciences. All of our programs share goals that are aligned with the University and College Missions and our curricula are integrated with research activities, internships and skills development that assist in professional development.

Accomplishments and Success of SESS

Over the past five years from 2015-2020, SESS has evolved and achieved the following significant accomplishments:

<table>
<tr><th colspan="2">1. Consolidation of the Program Options</th></tr>
<tr><td colspan="2">Three options for B.S. Earth Science degree programs were offered until 2014, but options were consolidated to minimize a confusion for students and to create more focused degree programs. Currently two options are offered for B.S. Earth Science degree programs. This change significantly reduced the confusion for our major students and consolidated our degree program to unify the course work.</td></tr>
<tr><th>Previous Earth Science B.S. Programs</th><th>Current Earth Science B.S. Options</th></tr>
<tr><td>B.S. Degree in Earth Science, Option in Geo-Science (formerly Earth System Science)
B.S. Degree in Earth Science, Option in Geology
B.S. Degree in Earth Science, Option in Meteorology</td><td>B.S. Degree in Earth Science, Option in Geo-Science
B.S. Degree in Earth Science, Option in Environmental Science</td></tr>
<tr><th colspan="2">2. Prefix Change</th></tr>
<tr><td colspan="2">Courses offered in SESS had numerous prefixes. This created much confusion for students during registration and administrative challenges to keep track of the course. SESS consolidated all the course prefixes to have only three for courses offered in SESS. This change significantly benefited our students and ease the registration process.</td></tr>
<tr><th>Previous Program Prefixes</th><th>Current Program Prefixes</th></tr>
<tr><td>METR, GEOL, ASTR, ATMS, GEOS, OCEN, SELS, ES, and SUST.</td><td>ES, ENV, and SUST</td></tr>
</table>

3. Consolidation of Student Learning Outcomes (SLOs)
Prior to 2015, there were total of six SLOs, but SLO 5 and 6 were redundant. SESS combined the SLOs and now we have total of 5 SLOs. This change supported assessment plans to be more directive and quantitative.
4. Offer Programs throughout NJ
The Environmental Biology program was launched at the Kean Skylands Campus and the Kean Ocean Campus in the fall of 2019 each with a location-specific focus (forest ecology in the Skylands and marine/coastal ecology at Kean Ocean)
5. Guidesheet Updates
All program guidesheets were updated to make 120 credits with GPA requirements of 2.5 for BS programs and 2.0 for B.A. programs.
6. OER Incorporation
All SESS courses now offer an option of accessing Open educational resources (OER). This change helped our major students financially and provided wider range of resources.
7. Outreach Activities
Workshops for NJ high school science teachers and counselors were offered at least 1-2 per year to promote SESS programs to support recruitment effort. Articulations were developed with numerous community colleges and high schools, including Union County VoTech High School in which the high school seniors also become freshmen in our Sustainability Science program.
8. Student Research Accomplishments
Between 20-30 student authored research poster presentations from SESS were presented annually at Kean University's Research Days. The research results from a wide range of undergraduate research opportunities in the field and laboratorys with SESS faculty. Students also traveled to many national conferences and took part in research not only in New Jersey, but also throughout the U.S., China, Costa Rica, and India with our faculty.
9. Development of Transdisciplinary Courses
SESS transformed the traditional capstone course into a challenging transdisciplinary practicum course (SUST 4300). This course involves business partners in real practice as clients and students are engaged in projects. Our capstone course is truly student-driven project-based class to provide the real professional learning experience in environmental and sustainability sciences.
9. Minor Program Creations
Two minor programs have been created and offered: Environmental Justice and Sustainability Sciences. These offerings supported our students to be more competitive and marketable for their job search after graduation as well as providing more research opportunities.

Vision of SESS

By the year 2022, SESS plan to accomplish the following objectives:

- Rename B.S. Earth Science degree to B.S. Environmental Science without any options. This change will reduce the confusion in course selections for students as well as help the students be more marketable and competitive in their career search after graduation.
- Create an Environmental Health minor program. This offering will make our graduates to be significantly more competitive and marketable for their career preparation after graduation especially post-pandemic era.
- Continue to develop our degree-completion programs at Kean Ocean and Kean Skylands by working with the local community colleges on recruitment/outreach events and articulation agreements.

- Launch our Environmental Science program at Wenzhou Kean University in China.
- Unify lesson plans and laboratory activities for general education courses and low-level introductory courses to reduce variations among different sections and instructors.
- Create more interdisciplinary and transdisciplinary courses across degree programs to provide increased hands-on learning experiences
- Increase faculty-student publications in conference proceedings and journal publications
- Provide more travel and learn opportunities to emphasize global learning experiences
- Gain national and international reputation for offering a World Class program of Environmental and Sustainability Sciences Programs

Additional funding is needed to promote program growth in the following areas:

- **Faculty**: additional full-time faculty, with terminal degrees, should be hired by the SESS as we anticipate growth of the School and in order to adequately cover the subject matter and integration of disciplines found in the environmental and sustainability sciences. This would encourage further distinction of Kean and recognition of the program in the region, while also supporting enrollment growth in Environmental and Sustainability Sciences majors.
- **Renovation and Equipment**: additional laboratory space and equipment should be provided as faculty members are expanding their research activities and group to enhance efficiency and effectiveness of the School. Equipment should be purchased which can be shared among faculty members within SESS and across the University for use in teaching and research, lab experiences and practicum opportunities for students, and the availability of resources for collaborative work with external partners.
- **Academic Specialists**: one to two academic specialists per calendar year are needed to support the research activities (given there is presently no graduate program or graduate students) and to facilitate the faculty-student interaction and outreach activities.
- **Release Time for Research Credit**: faculty members involved in grant activities need to be awarded research credit to reduce the teaching load and focus on advisement of the research students and research activities that are laboratory and/or field intensive
- **Travel and Conference Support**: additional financial support should be provided to allow faculty and students to attend national conferences not otherwise available through funded grants. The additional support from the University will increase recognition and reputation of the program domestically and globally.

Assessment Strategy in SESS

Program assessments were conducted mainly using pre- and post-test results from representative courses such as ENV 1000, ES 1200, SUST 1000, ES 1200, and ES 1100. Different years selected different courses as well as different student learning outcomes to reflect student learning in SESS. This approach was successful for quantitative data analysis but our result also suggests that it lacks qualitative assessments such as logic development and critical thinking abilities. SESS plans to develop unified rubrics for qualitative assessment of the student learnings for both introductory and upper-level courses. SESS also recognizes that more upper-level courses should be used to truly reflect the student learning outcomes for our major students to evaluate the programs offered in SESS. Changes and development of assessment plans will be implemented by the year 2021.

Anticipated Changes in SESS

There are three main changes to our programs that we are going to be making over the next few years to consolidate our programs, increase enrollment, and adapt to rapidly evolving academic and professional fields.

First, we anticipate an elimination of B.S. Sustainability Science program from SESS following the 2019-20 AY to better reflect the administrative reorganization and consolidation effort. Enrollment of the B.S. Sustainability Science program has steadily declined over the past five years and it is difficult to justify the program as a stand-alone degree program. However, the minor program in Sustainability Science continues to be offered in SESS to provide professional opportunities to the students. By emphasizing the minor, we are fostering the embedded model of sustainability so that students of diverse disciplines including Design, Architecture, Business, Management, Biology, Environmental Science, Sociology, and Policical Science can understand how to incorporate the increasingly essential knowledge and tools of sustainability in their fields.

Second, the B.S. Earth Science will change its name to B.S. Environmental Sciences to support our graduates to be more competitive and marketable after graduation. The following courses are selected a major requirements to provide a comprehensive, hands-on learning experience and expertise in Environmental Science. The B.S. Program in GeoScience will be eliminated and those students interested in geoscience will be encouraged to join the Environmental Science program.

Focused Disciplines	***Course offered in B.S. Environmental Science Program for SESS students***
Hydrosphere	ES2400 – Oceanography
Geosphere	ES 1101 – Earth and Geog ES 2101 – Geo-Hydro Systems
Atmosphere	ES 1300 – Meteorology
Biosphere	ENV 2100 – Ecosystem Sci ENV 3051 – Field Biology
Sustainability	SUST 1000 – Sustainability Science SUST 2200 (Laws for Sust) or 3200 (Env, Health and Safety)
Technology	ES 3200 – GIS ES 3010 – Data Analysis
Instrumentation	ENV 1100 – Intro to Env Sci

Finally, an Environmental Health Minor program will be created to offer students of diverse disciplines with an understanding of how inextricably linked the environment is to human health. This minor program is expected to support not only SESS students, but also those of Biology, Public Health and Business/Marketing backgrounds with wider research and practicum experiences as well as to become more competitive and marketable for their career preparation in a world that is currently adjusting to a global pandemic (COVID-19). The following new courses are anticipated to be written and offered as part of this new minor program:

- Environmental Toxicology
- GIS for Infectious Disease
- Waterborne Disease and Water Treatment
- Epidemiology and Public Health

1. Mission, Student Learning Outcomes, and Curriculum Map

1.1. Mission Statement

1.1.1. B.S. in Earth Science with Environmental Science or Geoscience Option and B.S. in Biology with Environmental Biology Option

The mission of the faculty in the Earth Science and the Environmental Biology Programs within the School of Environmental and Sustainability Sciences (SESS) at Kean University is to offer a nationally and internationally recognized program that prepares students for a professional and academic careers in Environmental and Sustainability Sciences. All of our programs share goals that are aligned with the University and College Missions.

The goals of the Bachelor of Science in Earth Science and Biology (Environmental Biology) degree programs within SESS is to provide research-based training and experiences necessary for the next generation of environmental scientists to:

- recognize the complex and integrated nature of environmental, ecological, and geological related issues and questions facing the world today and in the future;
- address these issues and questions using the most current knowledge in their discipline, a multi-scale and trans-disciplinary approach and a keen awareness of the needs/concerns of society with respect to the sciences;
- make informed judgments and decisions about environmental issues to embrace the broader social and economic aspects of managing the environment based on scientific approaches;
- be successful in graduate school, other post-baccalaureate professional schools, or jobs in their respective scientific disciplines; and finally
- be the next generation of environmental and earth scientists who have the ability to respond to immediate and future challenges through critical scientific thinking and analysis supported by excellence in scholarship and communication

To adequately prepare our graduates and to help them attain the above listed skillset and qualifications, our programs are aimed to:

- provide students from diverse backgrounds with extraordinary educational experiences involving coursework, research opportunities and an internship to understand and confront contemporary environmental, societal, and economic issues best examined and addressed by Sustainability Science;
- prepare students for employment in the growing fields associated with earth and environmental sciences;
- train students to assess both qualitative and quantitative data from holistic perspectives to make informed judgments and decisions about environmental issues to embrace the broader social and economic aspects of managing the environment based on scientific approaches;
- provide challenging and competitive curriculum to be successful in graduate school, other post-baccalaureate professional schools, or jobs in their respective scientific disciplines;
- educate students to be the knowledgeable and enthusiastic environmental and earth scientists and citizens with life-long engagements and increased environmental stewardship to become the next generation ambassadors for environmental and earth sciences; and finally

- promote broad intellectual inquiry throughout and beyond the Kean community to continue the life-long learning engagement in environmental and earth sciences beyond the Kean community.

1.1. 2. B.S. Sustainability Sciences

The Sustainability Science program, in the SESS at Kean University, is unique with only a few nationally comparable programs being offered at Universities. Currently, there are two concentrations under the Sustainability BS program. One is the "Business and Energy Concentration", which is more in line with the occupational areas addressed renewable energy, green building, and health and safety. The other is the "Environmental Engineering Concentration", which requires the same General Education courses as the Business and Energy Concentration, but also adds several new courses for Major Requirements and Program Focus-Related Electives in order to meet the "Environmental Engineering Concentration" requirements under the ABET Engineering Accreditation Criteria For Environmental Engineering. Although this program is not ABET Certified, the program prepares the students for a smooth transition into an environmental engineering graduate program.

The mission of the program is to:

- provide students from diverse backgrounds with extraordinary educational experiences involving coursework, research opportunities, and an internship to understand and confront contemporary environmental, societal, and economic issues best examined and addressed by sustainability science;
- train students to assess both qualitative and quantitative data from holistic perspectives to make informed judgments and decisions about environmental issues to embrace the broader social and economic aspects of managing the environment based on scientific approaches;
- prepare students to obtain professional certificates in various professional areas, which is essentials to promote their future careers;
- prepare students for employment in the growing fields associated with sustainability; and/or
- prepare students for graduate programs in sustainability and/or law school programs associated with sustainability or Environmental Engineering.

1.1.3. B.A. in Earth Science with General Option, Teacher Certification Option, or Teacher of Students with Disabilities Option

The B.A. Earth Science programs are designed to provide a broad spectrum of Earth Science disciplines and to prepare the student for teacher certification in earth science and elementary education with an earth science specialization. The programs are also designed to prepare students for career in both public and private sectors jobs where diverse interdisciplinary knowledge in Earth Science discipline is required. The strong interdisciplinary approach and system approach to study the Earth as a system cover a wide aspect from the traditional Earth Science specialty areas such as geology, meteorology, oceanography, geography, environment science and also astronomy. The mission of the program from these diverse specialties in Earth Science is to provide students with strong scientific background, interdisciplinary problem solving skills and strong communication skills.

The goals of B.A. degree programs in SESS is to provide the training and experiences necessary for the next generation of Earth Scientists and teachers by offering the curriculum focusing on the following student learning objectives:

- gain knowledge of the physical, chemical, and biological processes operating in the Earth system;

- learn technology-based methods to solve geologic problems and communicate results;
- understand the basic scientific principles of geology and environmental sciences, including the basis of scientific laws and theories, and where the earth and society fit within that framework;
- effectively communicate scientific observations, analyses and arguments;
- critically evaluate the scientific merit of scholarly literature and lectures;
- learn to collect, analyze and interpret geologic and earth system data scientifically; and finally,
- promote awareness of the connected nature of the Earth system, including the effects of humans.

1.1.4. Consistency with University Mission

Kean University is a public cosmopolitan university serving undergraduate and graduate students in the liberal arts and the sciences. The University dedicates itself to the intellectual, cultural, and personal growth of all its members — students, faculty, and professional staff. "In particular, the University prepares students to think critically, creatively and globally; to adapt to changing social, economic, and technological environments; and to serve as active and contributing members of their communities" (www.kean.edu). The School of Environmental and Sustainability Sciences (SESS) had adopted university-based objectives to accomplish the degree program mission. The expectation is that our graduates will:

- Think critically, creatively, and globally
- Adapt to changing social, economic, and technological environments
- Serve as active and contributing members of their communities
- Advance their knowledge in the traditional discipline (GE) and enhance their skills in the professional area of Environmental Sciences
- Maintain a student-centered educational environment in which diversity can flourish and an atmosphere in which mutual respect characterizes relations among the members of a pluralistic community
- Benefit from educational opportunities in national and international arenas

These objectives for graduates have been successfully aligned with the School's student learning outcomes and are based on nationally recommended learning outcomes. An annual survey on students will be used to determine whether or not they are adequately prepared for careers in their professions.

Kean's mission is to provide a world-class education requires responsible stewardship of Earth and its resources. Actions taken today will help ensure a vibrant learning environment for generations to come. As University President Dawood Farahi notes:

> "We all have an obligation as good neighbors to make choices that do not harm our planet. As an institution of higher education – especially one with so many students and graduates working with young people in the classroom – we have an even higher calling to demonstrate what is possible."

Kean University is becoming increasingly positioned to become a leader in the field of Environmental Sciences. In the fall of 2019, Kean University officially opened the new Skylands Campus on over 40 acres of protected forest/lake habitat surrounded by thousands of acres of protected state forest. This campus has environmental science as its core strength and is an ideal location for students to learn about ecocystems through hands-on classes and research alongside of SESS faculty.

Kean is an interactive university and serves as a major resource for regional advancement. Kean collaborates with business, labor, government and the arts, as well as educational and community

organizations and provides the region with cultural events and opportunities for continuous learning. This makes the University to be the home for interactive, developing and challenging environmental science centers and hubs for different stakeholders.

The focus on achieving research excellence is supported by a commitment to research, scholarship, creative work, and innovative uses of technology. This focus includes the advancement of knowledge in the traditional disciplines and the enhancement of skills in professional areas. Kean is committed to providing global educational opportunities for students and faculty.

1.1.5. Academic and Professional Standards

The BS Earth Science Programs in SESS are consistent with the academic and professional standards within each option. Through research and education opportunities, faculty help students achieve a strong scientific background, research skills, develop critical thinking, analytical capabilities, interdisciplinary problem solving skills abilities, and strong communication skills. SESS students will apply their knowledge to the environment around them through specialized course work and individual and team-based scientific research projects. Students fully integrate the Earth Science domains of land, water, and air with regard to interactions, impacts, and processes relevant to life systems and hazards. Solving contemporary problems requires a critical multi-scale and trans-disciplinary background and perspective, and the awareness of the needs or concerns of society. These are the values SESS Faculty share between themselves and with students.

The BS Earth Science program with both environmental science and geoscience option is fully consistent with the academic and professional standards of Kean University that include guiding students in the educational experiences and provide them with the knowledge, skills, abilities, and experiences that will position them to demonstrate comprehension of:

1. the unique characteristics of Earth that have facilitated the development and evolution of life as we know it,
2. the human actions and behaviors that are compromising these characteristics,
3. the reasons behind why humans are acting and behaving in unsustainable ways and
4. the solutions that will produce long-term reversal, if not elimination, of unsustainable actions and behaviors in favor of those that are sustainable

The program seeks to empower students to embrace sustainable lifestyles whereby they will serve as ambassadors for others in their personal and professional communities through life-long commitment to environmental and earth science interests and education.

1.2. Student Learning Outcomes (SLOs)

1.2.1. SLOs for B.S. Earth Science with Environmental Science and GeoScience Option and B.S. Biology with Environmental Biology Option

Five SLOs are identified for B.S. Earth Sciences and B.S. Biology with Environmental Biology option. All SLOs are introduced when students take Introduction to Earth and Geographic Systems (ES 1100) and Introduction to Environmental Sciences (ENV1000). The concepts are later reinforced in all 2000 level courses. In all higher-level courses, SLO1, SLO2, and SLO3 are either reinforced and/or mastered. However, SLO4, SLO5, and SLO6 are more emphasized in all ES 3000 and 4000 courses. These SLOs are identified and aligned throughout the program courses to be aligned with the University Mission and General Education requirements. SLO 1 and SLO 2 are dedicated to the acquisition of knowledge, while

SLO 3 involves the application of knowledge for use in appraisal of behaviors. Evaluation and application of solutions occurs in SLO 4, while SLO 5 is reserved for lifelong learning practices. Appropriate University-based and General Education outcomes have been aligned to the sustainability outcomes, which enables resident faculty to measure the level of knowledge and skills developed by students for anticipated careers in sustainability science. Both B.S. degree programs (B.S. Earth Science and B.S. Biology) share the same SLOs except SLO 5 with slight different emphasis. Followings are the specific SLOs:

SLO 1: Demonstrate technical knowledge and skills as well as an understanding of the basic mechanisms and processes associated with biological, atmospheric, geologic, hydrologic, and geographic systems as unifying principles of contemporary environmental and earth science relevant to their own discipline and to those related disciplines in an operationally oriented research environment. This includes basic principles, theories, methods, and protocols for scientific discovery and problem-solving (KU 1, 2) (GE K1, K2, K3, S1, S2, S3)

SLO2: Articulate and demonstrate critical thinking/analysis with regard to application of methods and findings. This includes designing and conducting efficient and targeted scientific studies of contemporary problems in the environmental biological and earth sciences. Synthesize and integrate multiple dynamic and system processes and their interactions as well as impacts on, and interactions with, human and societal systems. (KU 1, 2, 3, 4) (GE K1, K2, K3, K4; S1, S2, S3, S4, S5, V1, V5).

SLO3: Appraise, validate, and synthesize relationships in a quantitative manner that expresses system behaviors and characteristics necessary for visualization, knowledge discovery, and prediction. This includes global and historical views and methods of environmental analysis. Analyze data using current, appropriate and efficient laboratory, field, appropriate software, and statistical methods in order to identify and visualize the discoveries and knowledge resulting from research projects that provide an understanding of causes, solutions, prediction of outcomes, etc. associated with these contemporary problems. (KU 2, 3) (GE K4, S1, S2, S3, S4, S5)

SLO4: Communicate scientific research findings and other information efficiently and convincingly to professional and community audiences using oral and written methods. (KU 1, KU4) (GE K1, K3, K4, S1, S2, S3, S4, S5, V1).

SLO5 (Different SLO for Environmental Biology and Earth Science majors):
B.S. Environmental Biology: Identify the interconnections among scientific disciplines and the multiple dynamic biotic and abiotic system processes associated with the various components of the environment. Identify how these can change under varying environmental conditions (both natural and anthropogenic); and apply these relationships to scientific investigation. Demonstrate a global perspective of the environmental and life sciences and how they are connected to a global society. (KU 1, 2, 3, 4) (GE K1, K2, K3; S1, S2, S3, S4, S5, V1, V2, V4).

B.S. Earth Science: Discern, design, research, analyze, interpret, apply, evaluate, verify, and implement research to identify and address fundamental and other questions, problems, or issues in Earth Science. This includes formulation of research questions, hypotheses and testing; critical observations, analysis, and visualization; access of pertinent data archives and their manipulation; and complex systems analysis and modeling. (KU 1, 2, 3, 4) (GE K1, K2, K3, K4, S1, S2, S3, S4, S5).

KU Student Outcomes (KU): Kean University graduates should be able to:

1. Think critically, creatively and globally;
2. Adapt to changing social, economic, and technological environments;
3. Serve as active and contributing members of their communities; and
4. Advance their knowledge in the traditional disciplines (GE) and enhance their skills in professional areas

****General Education Student Learning Outcomes**

Knowledge (GE-K): Students will demonstrate proficiency in knowledge and content by:

(K1) applying the scientific method to comprehend natural concepts and processes;
(K2) evaluating major theories and concepts in social sciences;
(K3) relating historical references to literature; and
(K4) evaluating major theories and concepts in the fine arts.

Skills (GE-S): Students will demonstrate the skills necessary to:
(S1) write to communicate and clarify learning;
(S2) communicate effectively through speech;
(S3) solve problems using quantitative reasoning;
(S4) think critically about concepts in multiple disciplines; and
(S5) show information literacy

Values (GE-V): Students will demonstrate personal, social and ethical responsibility as a part of lifelong learning through:
(V1) personal responsibility;
(V2) ethical & social responsibility;
(V3) active in social & civic engagement;
(V4) respect for diverse culture; and
(V5) lifelong learning

1.2.2. SLOs for B.S. Sustainability Sciences

Five SLOs of the B.S. in Sustainability Science program are introduced and assessed in 1000-level course work (SUST 1000). The concepts are reinforced in all 2000-level courses (SUST 2200). Mastery in the sustainability discipline does not occur until students are enrolled in 3000- and 4000-level coursework (SUST 3110, 3200, 3310, 3400, 3600, 4000, 4600, 4700 , and 4300). Similar to most Kean University degree programs, the capstone equivalent course (SUST 4300: Independent Practicum in Sustainability Science) is assessed to determine the effectiveness of skills learned for professional success.

SLO 1: Describe of the unique characteristics of Earth that have facilitated the development and evolution of life as we know it; the foundations of sustainability (KU 1, 4) (GE K1, K3, S1, S2, S5).

SLO 2: Name and explain the human actions and behaviors that are compromising these characteristics (KU 1, 2, 3, 4). (GE K1, K2, K3 S1, S2, S3, S4, S5 V1, V2, V3, V4)

SLO 3: Identify and appraise the reasons behind why humans are acting and behaving in unsustainable ways (KU 1, 2, 3, 4). (GE K1, K2, K3, S1, S2, S3, S4, S5, V1, V2, V3, V4)

SLO 4: Identify and evaluate of the solutions that will produce long-term reversal, if not elimination, of unsustainable actions and behaviors in favor of those that are sustainable (KU 1, 2, 3, 4) (GE K1, K2, K3, S1, S2, S3, S4, S5, V1, V2, V3, V4, V5)

SLO 5: Practice a commitment to sustainability and the importance of being a change agent for others (KU 1, 2, 3, 4) (GE K1, K2, K3, S1, S2, S3, S4, S5, V1, V2, V3, V4, V5)

KU Student Outcomes (KU): Kean University graduates should be able to:
1. Think critically, creatively and globally;
2. Adapt to changing social, economic, and technological environments;
3. Serve as active and contributing members of their communities; and

4. Advance their knowledge in the traditional disciplines (GE) and enhance their skills in professional areas

****General Education Student Learning Outcomes**

Knowledge (GE-K): Students will demonstrate proficiency in knowledge and content by:
(K1) applying the scientific method to comprehend natural concepts and processes;
(K2) evaluating major theories and concepts in social sciences;
(K3) relating historical references to literature; and
(K4) evaluating major theories and concepts in the fine arts.

Skills (GE-S): Students will demonstrate the skills necessary to:
(S1) write to communicate and clarify learning;
(S2) communicate effectively through speech;
(S3) solve problems using quantitative reasoning;
(S4) think critically about concepts in multiple disciplines; and
(S5) show information literacy

Values (GE-V): Students will demonstrate personal, social and ethical responsibility as a part of lifelong learning through:
(V1) personal responsibility;
(V2) ethical & social responsibility;
(V3) active in social & civic engagement;
(V4) respect for diverse culture; and
(V5) lifelong learning

1.2.3. SLOs for B.A. Earth Sciences with General Option, Teacher Certification Option, or Teacher of Students with Disabilities Option

The BA Earth Science curriculum has been created to help students achieve the five identified Student Learning Outcomes (SLOs). All five SLOs are introduced in all 1000-level courses including courses such as Introduction to Astronomy (ES 1100), Introduction to Geology (ES 1200), and Introduction to Meteorology (ES 1300). SLO1 is expected to be mastered in all 2000 or higher-level courses. SLO2, SLO3, SLO4, and SLO5 are reinforced in 3000-level courses, such as Introduction to Oceanography (ES 2400). The mastery of Earth science knowledge will happen when students take 4000-level courses. Capstone courses such as Environmental Issues Seminar (ES 4981), Earth Science Seminar (ES 4953 and ES 4954), and Honor Research Seminar (ES 4963 and ES 4964) courses are used to assess the success and effectiveness of a wide range of academic skills acquired by students throughout the years.

SLO1: Identify and explain different steps involved in the study and analysis of Earth Science phenomena. (KU1, KU3, GE K1, GES1, GES2, GES3, GES4, GES5, GEV1, GEV4)

SLO2: Analyze processes generating earth science phenomena and explain their spatial and temporal distribution. (KU1, GEK1, GES1, GES2, GES3, GES4, GES5, GEV1, GEV4).

SLO3: Distinguish and characterize the interrelationship between Earth Science factors. (KU1, GEK1, GES1, GES2, GES3, GES4, GES5, GEV1, GEV4)

SLO4: Examine, articulate and illustrate the interaction between Earth Science phenomena and people. (KU1, KU2, GEK1, GES1, GES2, GES3, GES4, GES5, GEV1, GEV2, GEV3, GEV4, GEV5)

SLO5: Demonstrate a good understanding and communication skills of Earth Science phenomena. (KU1, KU3, GEK1, GES1, GES2, GES3, GES4, GES5, GEV1, GEV4)

*** KU Student Outcomes:** ***Kean University graduates should be able to:***
1. Think critically, creatively and globally;
2. Adapt to changing social, economic, and technological environments;
3. Serve as active and contributing members of their communities; and
4. Advance their knowledge in the traditional disciplines (GE) and enhance their skills in professional areas (Prof. Programs)

****General Education Student Learning Outcomes**

Student Learning Outcomes – ***Knowledge:*** *Students will demonstrate proficiency in knowledge and content by:*
1. applying the scientific method to understand natural concepts and processes (GEK1)
2. evaluating major theories and concepts in social sciences (GEK2)
3. relating literature to historical context (GEK3)
4. evaluating major theories and concepts in the fine arts (GEK4)

Student Learning Outcomes – ***Skills:*** *Students will demonstrate the skills necessary to:*
1. write to communicate and clarify learning (GES1)
2. communicate effectively through speech (GES2)
3. solve problems using quantitative reasoning (GES3)
4. think critically about concepts in multiple disciplines (GES4)
5. demonstrate information literacy (GES5)

Student Learning Outcomes – ***Values:*** *Students will exhibit a set of values that demonstrates:*
1. personal responsibility (GEV1)
2. ethical and social responsibility (GEV2)
3. social and civic engagement (GEV3)
4. respect for diverse cultures and perspectives (GEV4)
5. life-long learning (GEV5)

1.3. Curriculum Map

1.3.1. Curriculum Map for B.S. Earth Science with Environmental Sciences and Geoscience Option

The curriculum for B.S. in Earth Science prepares students to achieve expected student learning outcomes identified by the profession. The following table demonstrates how learning activities that are measured within core courses of the B.S. Earth Science program for both Environmental Science and GeoScience options.

Table 1. B.S. in Earth Science Curriculum Map

I-Introduced R-Reinforced M-Mastery A-Assessment evidence collected

Required Courses	SLO1: Demonstrate Technical Knowledge	SLO2: Articulate Critical Thinking	SLO3: Validate and Synthesize Information	SLO4: Communicate the Scientific Information	SLO5: Implement the Knowledge to Current Issues
ENV 1000: Introduction to Environmental Science	I, A	I,A	I,A	I,A	I,A
ENV 1101: Intro to Earth and Geo System	I	I	I	I	I
ES 1200: Intro to Geology	I	I	I	I	I
ES 1300: Intro to Meteorology	I	I	I	I	I
SUST 1000: Intro to Sustainability	I, A	I, A	I, A	I, A	I, A
ES 2101: GeoHydro Systems	R	R	R	R	R
ENV 2100: Ecosystem Science	R	R	R	R	R
ES 2400: Intro to Oceanography	R	R	R	R	R
ENV 3100: Principle of Env Soil Sciences	R	R	R	R	R
ENV 3051: Field Biology	R	R	R	R	R
ES 3010: Data Analysis and Modeling	R	R	R	R	R
ES 3200: GIS in Geoscience	R	R	R	R	R
ES 4200: Remote Sensing	M, R	M, R	M, R	M, R	M, R
SUST 4300: Independent Practicum in Sustainability Science	M,A	M,A	M,A	M,A	M,A

1.3.2. Curriculum Map for B.S. Biology with Environmental Biology Option

The curriculum for B.S. in Environmental Biology prepares students to achieve expected student learning outcomes identified by the profession. The following table demonstrates how learning activities that are measured within core courses of the B.S. Environmental Biology program.

Table 2. B.S. in Environmental Biology Curriculum Map

I-Introduced	R-Reinforced		M-Mastery	A-Assessment evidence collected	
Required Courses	**SLO1: Demonstrate Technical Knowledge**	**SLO2: Articulate Critical Thinking**	**SLO3: Validate and Synthesize Information**	**SLO4: Communicate the Scientific Information**	**SLO5: Identify Interdisciplinary Practices and Applications**
ENV 1000: Introduction to Environmental Science	I, A	I,A	I,A	I,A	I,A
ENV 2000: Evolution and Biodiversity	I	I	I	I	I
ENV 2100: Ecosystem Science	I, R	I, R	I, R	I, R	I, R
ENV 3051: Field Biology	R, M	R, M	R, M	R, M	R, M
ENV 3100: Principle of Env Soil Sciences	R	R	R	R	R
ENV 3201: Biodiversity Assessment	R	R	R	R	R
ENV 4201: Conservation Biology	R, M	R, M	R, M	R, M	R, M
SUST 4300: Independent Practicum in Sustainability Science	M,A	M,A	M,A	M,A	M,A

1.3.3. Curriculum Map for B.S. Sustainability Sciences

The B.S. in Sustainability Science curriculum prepares students to achieve expected student learning outcomes identified by the profession. The following table demonstrates how learning activities are measured within core courses of the Sustainability Science program.

Table 3. B.S. in Sustainability Science Curriculum Map

I-Introduced R-Reinforced M-Mastery A-Assessment evidence collected

Required Courses	SLO1: Foundations of Sustainability	SLO2: Human Actions and Sustainability	SLO3: Understanding Human Actions and Sustainability	SLO4: Solutions to Sustainability Issues	SLO5: Change Agent for Sustainability
ENV 1000: Introduction to Environmental Science	I	I	I	I	I
ES 1101: Introduction to Earth and Geog Systems	I	I	I	I	I
SUST 1000: Introduction to Sustainability Science	1, A	1,A	1,A	1,A	I,A
ES 2101 Ge-hydro Systems	I	I	R	R	R
SUST 2200: Laws for Environ. Sustainability	I	R	R	R	R
ES 3200: GIS in Geoscience	R	R	R	R	R
SUST 3200: Environmental Heal and Safety	R	R	R	R	R
SUST 3110: Renewable Energy	R, M	R, M	R, M	R, M	R, M
SUST 3310: LEED Lab and AP Credential Preparation	R, M	R, M	R, M	R, M	R, M
SYST 3400 Intro to Environmental Engineering	R, M	R, M	R, M	R, M	R, M
SUST 3600: Global Sustainability Development	R, M	R, M	R, M	R, M	R, M
SUST 4000: Technologies for Sustainability	M	M	M	M	M
SUST 4110: Life Cycle Assessment	M	M	M	M	M
SUST 4600: Air Pollution Control	M	M	M	M	M
SUST 4700: Water and Wastewater Treatment	M	M	M	M	M
SUST 4300: Independent Practicum in Sustainability Science	M,A	M,A	M,A	M,A	M,A

1.3.4. Curriculum Map for B.A. Earth Sciences

The B.A. in Earth Science curriculum prepares students to achieve expected student learning outcomes identified by the profession. The following table demonstrates how learning activities are measured within core courses of the B.A. Earth Science program.

Table 4. B.A. in Earth Science Curriculum Map

I-Introduced	R-Reinforced		M-Mastery	A-Assessment evidence collected	
Required Courses	**SLO1: Identify and Explain Concepts**	**SLO2: Analyze Processes**	**SLO3: Characterize Interrelationships**	**SLO4: Examine and Articulate Earth Science**	**SLO5: Demonstrate Understanding and Communication**
ENV 1100: Introduction to Environmental Science	I, A	I,A	I,A	I,A	I,A
ES 1100: Intro to Astronomy	I	I	I	I	I
ES 1200: Intro to Geology	I	I	I	I	I
ES 1300: Intro to Meteorology	I	I	I	I	I
SUST 1000: Intro to Sustainability	I, A	I, A	I, A	I, A	I, A
ENV 3000 Courses	R	R	R	R	R
ES 3000 Courses	R	R	R	R	R
SUST 3000 Courses	R	R	R	R	R
ENV 4000 Courses	M, R	M, R	M, R	M, R	M, R
ES 4000 Courses	M, R	M, R	M, R	M, R	M, R
ES 4981: Environmental Issue Seminar	M,A	M,A	M,A	M,A	M,A